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The following communications were read : —

I. On the Computation of observed Occultations, by Mr. Maclear.

When observed occultations are used either for determining the longitude of the place of observation or the errors of the lunar tables, it is desirable to compute the parallaxes correctly in the first instance, so that they may not be affected by any error in the assumed longitude of the place of observation. This is attained by finding what has been technically called " the point of occultation," or the parallaxes of the occulting point of the moon, which, whatever be the longitude of the place, depend solely upon the horizontal parallax at that moment, the geocentric latitude and sidereal time of the place, and the right ascension and declination of the star.

It is evident, that if we suppose the star to be elevated as much as that portion of the moon with which it is in contact is depressed by parallax, it would still appear in contact to a spectator at the centre of the earth,* and the operation of finding the longitude will proceed as if the observation were made at the centre.

Mr. Maclear has investigated accurate expressions for the parallaxes of the point of occultation, which are as follow :—

$$\text{sin parallax in } \text{Æ} = \frac{\sin \text{hor}^{\text{l}}.\ \text{par.} \times \cos \text{lat.} \times \sin \text{hor}^{\text{y}}.\ \text{angle of star}}{\cos (\text{declin. of star} + \text{par. in declin.})}$$

$$\text{sin parallax in declin.} = \sin \text{hor}^{\text{l}}.\ \text{par.} \times \sin \text{lat.} \times \cos \text{declin. of star}$$

$$\frac{\sin \text{hor}^{\text{l}}.\ \text{par.} \times \cos \text{lat.} \times \sin \text{star's declin.} \times \cos (\text{star's hor}^{\text{y}}.\ \text{ang.} - \tfrac{1}{2}\ \text{par. Æ})}{\cos \tfrac{1}{2}\ \text{par. in Æ.}}$$

The inconvenience of thus reciprocally involving the quantities sought for in the expressions from which they are to be obtained, is inevitable, unless we increase the number of terms, or sacrifice accuracy. The parallax in declination may be computed very nearly, neglecting the parallax in right ascension; and with this

* There is a very slight difference, which is investigated by the author, and shewn rarely to exceed a fraction of a second of space.

value the parallax in right ascension may be obtained with sufficient accuracy. The second part of the parallax in declination may now be recomputed, if necessary.

Mr. Maclear then gives practical rules for computation, adapted to common and to proportional logarithms, with several examples, and subjoins tables for the reduction to geocentric latitude, and logarithms of the earth's radius for every three degrees of latitude, the compression being assumed $\frac{1}{300}$.

II. Observations of the Right Ascension of Venus, to determine the Mass of the Moon, (as recommended by Professor Airy), by Professor Nicolai, at Mannheim, and Professor Schwerd, at Spire.

19 right ascensions of the bright limb of Venus, observed on the meridian of Mannheim, from March 3 to April 30, reduced by the catalogue of the Berlin Ephemeris for 1830; with the mean solar time of transit at Mannheim.

20 apparent right ascensions and declinations of the bright limb of Venus, from January 9 to March 29, observed on the meridian of Spire.

Along with the observations of Venus, Professor Nicolai has sent his observations of Gambart's comet, viz.

28 apparent right ascensions and declinations of the comet, from May 18 to July 27, with the corresponding mean solar time, observed with a circular micrometer applied to a $4\frac{1}{2}$ feet telescope by Fraunhofer.

"From these observations, up to the 25th of June, along with the first Marseilles observation of April 21, I have deduced the following parabolic elements of the comet, which represent with great accuracy the July observations."

April 1830.

Time of the perihelion.	9·32533	M. T. at Mannheim, 24 m 30 s east of Paris.
Log. of least distance	9·9644660	
Long. of perihelion	212° 11′ 46″,9	From the mean equinox of April 9.
Long. of ascending node ...	206 21 43 ,9	
Inclination of orbit	21 16 29 ,1	

Motion direct.

"In the computation of these elements, I have had regard to aberration and parallax, as well as to precession and nutation."

III. Observations of the Right Ascension of Venus, about her inferior Conjunction, by Professor Santini, at the Imperial and Royal Observatory of Padua.

The instrument used for these observations is a transit telescope, by Reichenbach, of $3\frac{1}{2}$ feet focal length. The position of the instrument is ascertained by a very sensible level, and by a meridian mark. At night, when the mark is not visible, the azimuthal deviation is obtained from the transits of the fundamental stars, and corrections for the position of the instrument applied to the observed

transits. Professor Santini expresses a fear that the supports of the instrument are not so stable, or the clock so equable in its rate, as may be necessary for these very delicate observations.

47 observations of the right ascension of the enlightened limb of Venus, with the fundamental stars with which it is compared, and the resulting error of the small Ephemeris of Venus distributed by the Society.

Along with the observations of Venus, Professor Santini has transmitted positions of Gambart's comet, deduced from observations with the equatorial instrument of the Observatory of Padua, by himself and his colleague, Dr. Conti.

50 positions of the comet of Gambart, in right ascension and declination, with the corresponding mean time of Padua, from April 30 to June 13.

"From the observations of the 30th of April, and of the 8th and 18th of March, I have deduced the following parabolic elements, without regard to the small corrections due to aberration and parallax, and they continue to satisfy the observed places. Whence we may conclude, that the orbit will only require some minute corrections, and that it is nearly parabolic. In the catalogue of comets published by Professor Schumacher I do not find any one which resembles it."

	April 1830.	
Passage of the perihelion.....	9·63804	Mean time at Padua.
Log. of perihelion distance ...	9·9650486	
Longitude of perihelion	212° 23′ 18″,8	Reckoned from mean equinox.
——— node.....	206 22 43 ,1	
Inclination of the orbit.....	21 11 8 ,8	

Motion direct.

IV. A Letter from Professor Bianchi, of Modena, containing Observations of the Right Ascension of Venus.

These observations were made with the meridian circle by Reichenbach, and the time taken from an excellent clock with a mercurial pendulum, by Molyneux. Professor Bianchi gives the transits of the fundamental stars, and 63 transits of Venus, as observed between the 2d of January and the 9th of May.

As no sensible change of inclination could be detected in the instrument, the rate of the clock was determined by transits of α Cygni which are nearly independent of changes in azimuth. The position of the instrument in azimuth was also verified as often as possible by a very distant meridian mark; and as, in this respect also, no variation could be perceived, Professor Bianchi preferred calculating "the mixed equation of the clock and instrument" for stars nearly in the parallel of Venus, without ascertaining the actual error of the clock, or the deviation of the instrument from the meridian. The mixed equation is thus determined. The *apparent* places of certain fundamental stars being first computed, the

difference between these and the *observed* places may arise from two causes; the error of the clock, and the displacement of the instrument. The form of this error is $m + c \sec \delta + n \tan \delta$; and since m affects all stars alike, the effect of the variable part on Venus may be determined by comparing stars nearly in her parallel with fundamental stars differing in declination. In this way, values of the variable part of the error have been obtained for each month for the stars near her parallel, by comparing them with α Lyræ, α Cygni, α Andromedæ, Capella, and Sirius, which, when combined with the clock rate and clock error as shewn by these fundamental stars, gives the correction to be applied to the observed right ascension of Venus, in order to obtain the true right ascension.

In this manner the right ascension of the bright limb of Venus has been finally ascertained, and compared with the small Ephemeris.

Several measures of the diameter of Venus are added, which have been deduced from repeated observations with the double-image micrometer of Professor Amici, applied to a 30-inch telescope by Dollond, and confirmed by observing the upper and lower limbs of Venus with the meridian circle. Professor Bianchi has also added

25 positions in declination of the centre of Venus, between March 15 and May 8, corrected for refraction.

V. Occultations of the Stars and Planets observed at Dorpat, by Professor Struve.

Professor Struve observes, that "even with such a powerful telescope as the Dorpat refractor, it is not easy to observe the *emersion* of faint stars from the moon's bright limb. But the micrometer, with the clock-work horary motion, affords a very satisfactory method of measuring the distance of a star, after emersion from the enlightened disc. These observations replace a lost emersion, and have even this advantage over an emersion exactly observed—that they do not depend upon the inequalities of the edge of the moon. Such micrometrical measures, both at immersion and emersion, will be found in the accompanying occultations of the Hyades. An accurate computation will shew what degree of accuracy may be expected from this mode of observing, and if there be a constant error in the apparent diameter of the moon depending upon the telescope employed. These measurements are, however, very difficult, and, I should think, better adapted to Fraunhofer's heliometer than to the wire micrometer."

The telescopes were variously adjusted, upon close double stars, upon Aldebaran, and upon the moon; but though there were four or more observers, in no instance was any projection seen. The disappearances took place instantaneously, when the apparent centre of the star entered upon the edge of the moon, and the re-appearances were also instantaneous; neither was there any previous variation in the brilliance of the star.

The observations consist of

An occultation of Saturn by the moon	16 Feb.	1826	
An occultation of α Tauri	25 July	1829	Four observers.
———————	15 Oct.	——	———
Occultations of α Tauri and the Hyades	9 Dec.	——	Six observers.
Occultations of the Hyades	28 Mar.	1830	

VI. Two Notes by Mr. Lubbock, on the Comet of Halley.

In the first of these notes Mr. Lubbock has deduced the elements of the orbit of this comet from Messier's observations, adopting the value of the semiaxis major given by M. de Pontécoulant, and the perturbations due to the principal planets computed by M. Damoiseau. The elements thus obtained satisfy, with considerable exactness, Messier's observations from Jan. 22 to June 3, as is seen from an accompanying table; and as they differ sensibly from those stated by the author in his paper, vol. iv. p. 42, he wishes them to be substituted in that place.

Semiaxis major	18·0763	
Eccentricity	·9676	
Perihelion passage, 1759, March	13·333	Mean time from Paris midnight.
Inclination of orbit	17° 36′	
Longitude of the ascending node	53 45	Referred to the mean equinox
Longitude of perihelion.....	303 3 20	1759.

Adding to the above elements the perturbations given by M. de Pontécoulant, the elements for 1835 are as follow:

Semiaxis major	17·98355	
Eccentricity	·967348	
Perihelion passage, 1835, Oct. 31	$4^h\ 47^m$	Mean time from Paris midnight.
Inclination.....	17° 42′ 50″	
Longitude of ascending node	55 3 59	
Longitude of perihelion.	304 23 39	

Mr. Lubbock then briefly explains the mode by which these elements were computed.

In the second note, Mr. Lubbock analyses a very valuable paper upon the same subject, by M. Rosenberger, contained in the *Astron. Nach.* Nos. 180 and 181.

M. Rosenberger first obtained approximate elements from 5 of Messier's observations, adopting the semiaxis major of Damoiseau. He then calculated the effect produced upon the elements by the perturbations of the seven large planets, for every ten days, from the 1st of January to the end of May, 1759. With the corrected elements belonging to each day, he computed an ephemeris of the comet, employing, for this purpose, the Solar Tables of Carlini, as corrected by Bessel, having regard both to precession and nutation. These computed places were carefully compared with the observed places. The positions of the stars with which the comet was compared were taken, when possible, from the *Fundamenta Astronomiæ*, or Piazzi's catalogue. When these were wanting, the *Histoire Céleste* and Bessel's *Zones* were resorted

to, and many stars were determined by Professor Bessel for this purpose. In reducing the observations, parallax and the differences of refraction were taken into account. Finally, all the observations which could be depended upon, those of Messier, Maraldi, Cassini, Bradley, Hell, and Darquier, were combined and made use of by the method of least squares. The elements resulting from this comparison are compared with Messier's observations, and the differences do not exceed half a minute in space. Mr. Lubbock finds the differences between his elements and those of M. Rosenberger more considerable than he had expected, especially the eccentricity: they are, however, of the order of the uncertainty which must exist in the calculation of the perturbations of the elements, between 1759 and 1835, and therefore practically of little importance.

It is to be regretted that M. Rosenberger has not used the semiaxis major of M. de Pontécoulant. He has, however, computed the variation of the elements produced by a small change in the semiaxis major, whence, adopting the value given by M. de Pontécoulant, the elements of the orbit are

Semiaxis major	18·0763	
Eccentricity	·96766333	
Perihelion passage, 1759, March	13·0763	Mean time from Paris midnight.
Longitude of ascending node	53° 47′ 47″,19	
Distance of perihelion from node	110 37 27 ,90	
Inclination of orbit	17 21 44	

Mr. Lubbock is, however, inclined to doubt whether this method is applicable, except when the change in the semiaxis major is very minute.

"This comet is one of those which most nearly approach the orbit of the earth. When in one of its nodes, it may be at a distance from us equal to $\frac{1}{20}$ of our distance from the sun; but the mass is so small, that a much nearer approach would give no just cause for alarm.

"It is to be hoped that ephemerides of this comet will be given for 1835, calculated upon at least three different hypotheses, with respect to its perihelion passage, in order that astronomers may know the lines in which to sweep for it each day, so that it may be detected as early as possible."

VII. A Letter from Mr. Herapath to the President, announcing the discovery of a comet.

"The first sight I had of the comet was on the 7th of January, on Hounslow Heath, about 6 A.M. The tail was then nearly perpendicular to the horizon, inclining towards the south, and of a white colour, apparently between 1° and 2° long. The head was of the same colour as the tail, but, in proportion, far more splendid. To me, it appeared to equal in light stars of the second magnitude, while it exceeded them in size."

Mr. Herapath took its distance with a sextant from two bright

stars, and found the distance of the comet from Arcturus 60° 50′, and from α Lyræ 52° 45′, (the latter observation a little uncertain), at about $6^h\ 30^m$ mean solar time.

From these observations, Mr. Herapath concludes, as an approximate place of the comet,

Jan. 7. $6^h\ 30^m$ A.M. Æ $17^h\ 36^m\ 44^s$ S. Dec. $12^\circ\ 33'$

An observation made by Sir James South, about 48 hours afterwards, gives

Æ $17^h\ 27^m\ 57^s$ S. Dec. $12^\circ\ 1'\ 12''$

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